DOE Risk Management

Volume 5, Issue 2 **Q U A R T E R L Y** **May 1997**

Letter From the Editor:

This is an exciting issue for two reasons. First, the RMQ is now on the Internet. Many thanks to George Schlossnagle for helping us work through the details to get it there. You can find this issue as well as some previous issues at: http://tis-hq.eh.doe.gov/chem_ safety/

We plan to have all prior RMQ issues on the Internet soon. Many of you wrote that you had access to the Internet and would like to receive the RMQ that way. We still need to hear from more of you. Please drop us an Email message if you can receive the RMQ electronically. Reducing the number of copies we print will considerably cut our costs and allow us to continue to provide this service.

Secondly, we have an interesting article from Andy Marchese concerning the nuclear safety program in the United Kingdom. One of our goals is to share what's happening relevant to risk not only within DOE but in other agencies, companies and countries. We look forward to printing other articles about risk-related information from around the world in future issues.

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Inside This Edition

Emergency Information Where It's Needed

by Lois Thiede, RMQ Editor

Emergency personnel responding to an accidental chemical spill need information at their fingertips about the chemical and how it can affect exposed members of the public. The American Industrial Hygiene Association (AIHA) has provided a pocket-sized handbook for use in the field with the latest Emergency Response Planning Guidelines (ERPG). ERPGs are published in ***The AIHA 1997 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook***, AIHA, Fairfax, VA. (Stock #247-EA-97).

In response to the Bhopal accident, several companies independently started to develop emergency planning guideline numbers.

The handbook was first published in pocket form in 1996. With an annual update published early each year, the 1997 update is now available. The 1997 update includes ERPGs for 70 chemicals with 10 of them either new or revised from the 1996 version. Currently about eight new chemical values are annually being added to the list. For those who need detailed information on adverse chemical health effects, AIHA still provides the full-sized ERPG documentation. This 8½ x 11 notebook gives complete descriptions of the chemicals, the data used to determine the ERPGs, and other relevant information about the chemical.

The handbook provides the background information needed to understand ERPGs including why and how they were developed. Beginning with the tragic 1981 accidental release of methyl isocyanate at Bhopal, India, which emphasized the need to understand emergency exposures to the general public, the handbook explains how several occupational guidelines eventually resulted in the ERPGs which are most useful for non-worker situations.

In response to the Bhopal accident, several companies independently started to develop emergency planning guideline numbers. Each separately reached the same conclusions:

1. The numbers are useful primarily for emergency planning and response.
2. The numbers are suitable for protection for health effects due to short-term exposures. They are not suitable for effects due to repeated exposures, nor as ambient air quality guidelines.
3. The numbers are guidelines. They are not absolute levels demarcating safe from hazardous conditions.
4. The numbers do not necessarily indicate levels at which specific actions must be taken.
5. The numbers are only one element of the planning activities needed to develop a program to

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protect the neighboring community.

6. The selection of chemicals needing emergency planning guidelines generally should be based on volatility, toxicity, and releasable quantities.

After these conclusions were presented to the AIHA, the organization established the Emergency Response Planning (ERP) Committee to provide an integrated approach. The ERP Committee includes industrial hygienists, toxicologists, and physicians representing a diverse group encompassing academia, industry, and governments (state, federal, and international). "The ERP Committee works to provide a very 'real world' – practical and useful -- understanding of the numbers. The ERPG number is there to protect people. If it's not conservative enough, emergency planning or response may not protect people. But if the ERPG value is too conservative, it can also hurt people, for example, by causing undue alarm and forcing an evacuation in a situation where it's not necessary. The committee is working hard to provide very accurate numbers that planners can be confident in," explains John Meagher, Manager of Scientific Affairs for AIHA.

One participant in the development and application of ERPGs is the Subcommittee on Consequence Assessment and Protective Actions (SCAPA) of the U.S. Department of Energy (DOE). Through SCAPA DOE has worked closely with AIHA and other organizations to develop accurate and useful ERPGs. SCAPA was established by the Emergency Management Advisory Committee of DOE to assist the Director of Emergency Management. SCAPA provides DOE with technical recommendations (radiological and nonradiological) in the area of emergency preparedness related to the health and safety of workers and the public. More information on SCAPA can be found on the Internet at: http://www.sep.bnl.gov/es/scapa. htm. The current SCAPA Working List of ERPGs, including ERPGs approved but not yet published, is also available at that address.

The committee is working hard to provide very accurate numbers that planners can be confident in.

Many professionals use ERPGs including community emergency planners and response specialists; air dispersion modelers; industrial process safety engineers; implementers of environmental regulations such as the Superfund Amendment and Reauthorization Act; industrial hygienists and toxicologists; transportation safety engineers; fire protection specialists; and government agencies (e.g., states, EPA, DOE, DOT, ATSDR, the Netherlands). "At DOE, the ERPGs are very important for emergency management. We do hazard assessment and consequence analysis based on the health effect levels and exposures supplied by the ERPGs," explains Dr. Doan Hansen, SCAPA Technical Coordinator and Secretary of AIHA's ERP Committee.

The ERPG number is there to protect people. If it's not conservative enough, emergency planning or response may not protect people. But if the ERPG value is too conservative, it can also hurt people…..

To get copies of ***The AIHA 1997 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook***, contact AIHA Support Services at 703-849-8888 or fax 703-207-3561. They can be reached via Email at InfoNet@AIHA.org. Copies will be shipped out within two days. AIHA would also appreciate hearing from users of the pocket handbook as to whether more or different information should be included in the handbook and other ways to make the handbook more useful in the field. Comments can be sent to Doan Hansen at Doan@bnl.gov or jmeagher@AIHA.org. ***RMQ***

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United Kingdom/Atomic Weapons Establishment Approach to Safety Analysis Reports

by Andrew R. Marchese, U.S. Department of Energy

Recently I met with Dr. Nigel J. Holloway, a safety consultant for the Director of Safety and Health, United Kingdom (UK) Atomic Weapons Establishment (AWE) to discuss their approach to developing Safety Analysis Reports, which are a requirement for the Nuclear Installations Inspectorate (NII) Licensing Programme. The following is a summary of some important highlights of the meeting with Dr. Holloway.

Nuclear weapons sites operated by the AWE at Aldermaston and Burghfield will lose their exemption from licensing in 1997 due to conversion of the sites to contractor-operated sites. The licensing program requires that Safety Analysis Reports (referred to in the U.K. as Safety Cases) be prepared for all major plants. It is required that the reports include substantial probabilistic risk assessments (PRAs) which constitute about 50% of the total safety case. Dr. Holloway discussed the development of the Safety Case Programme since it began in 1993. During the past three years, the AWE developed and implemented PRA-based risk assessment procedures that incorporated standardized analysis methods applicable to weapons facilities of all types and ages.

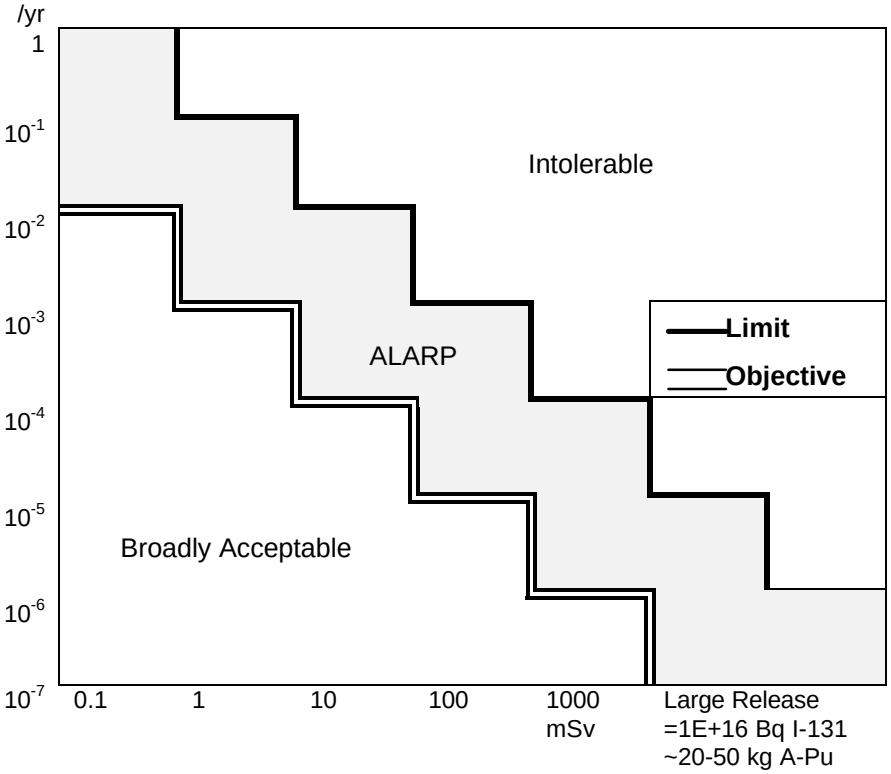
The Safety Case consists primarily of a hazards analysis, a risk assessment, and the resulting findings for a broad spectrum of accident conditions. Also included is background information, such as a description of the plant and processes, the operational history, safety management, decommissioning issues and plant acceptability based on established criteria. Both worker and public risks are assessed and PRA methods and criteria are used for both. Because there is usually much more risk to the worker, the majority of the effort is in the area of worker risk.

The PRA process includes hazard identification, probable accident sequences, and the assessment of systems to protect the public and workers. Accidents having very low consequences and/or very low probabilities are screened out. The resulting risk assessment includes an estimate of the "screened out" risks and a more detailed review of dominant risks. An assessment of total risks for workers and the public is presented.

The risk assessment process is standardized with respect to acceptable limits for release fractions for accidents, worker dose from inhalation of material, worker dose from contaminated wounds, off-site consequences and risks, dose coefficients, risks per Sv dose, aircraft crashes, seismic and other natural external events. Models for worker doses in-

STAIRCASE PRINCIPLE

DOSE BAND	BSL FREQUENCY	BSO FREQUENCY
0.1-1 mSv	1	0.01
1-10 mSv	0.1	1E-3
10-100 mSv	0.01	1E-4
100-1000 mSv	1E-3	1E-5
>1000 mSv	1E-4	1E-6
Large Release	1E-5	1E-7



AWE Interpretation: Dose is assessed at a standard distance of 1 km; ground level release, dry deposition; averaged over wind/weather stability classes; no countermeasures

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clude an expanding cloud model and the new ICRP Lung model. The risk criteria is then categorized into a two-level system: a basic safety limit (BSL) of 10^{-4} risk of death per year representing the outside limit of tolerable risk and a basic safety objective (BSO) of 10^{-6} risk of death per year which is considered a broadly acceptable risk. Values above the BSL are intolerable and must be addressed. Those between BSL and BSO must be justified using the As Low As Reasonably Achievable (ALARA) principle. Values below BSO carry no requirement to reduce risk. A dose band "staircase dose" schematic shown on the previous page has been developed to address societal risk.

Criticality accidents are not currently assessed using PRA; however, pilot studies for applying PRA to criticality accidents are underway. Line of Defense (LOD) analysis is applied to criticality accidents, with a minimum requirement for one strong Line of Defense; however, two strong LODs are preferred.

Through the use of PRA, criteria were established for classifying safety systems (including hardware, software and procedures) into three priority classes; namely: Safety Critical-1, Safety Critical-2, and Safety Related. Qualifying levels for each priority class were based on clearly defined safe working limits based on risk and consequences criteria relevant to workers and the public as two discrete categories.

The PRA Process also categorized risks and causes as to their level of importance according to types of facility or nature of the activity. For example, in plutonium (Pu) component facilities, Pu contaminated wounds and major fires were ranked as important, while liquid spills, glove leaks and waste drum accidents were found to be unimportant. Medium fires and major glove failures were in the medium range. Risks and causes are similarly defined and ranked for highly-enriched uranium facilities, weapon assembly facilities and decommissioning and waste storage activities.

The concept of As Low as Reasonably Practicable (ALARP) which is the U.K.'s highest level legal safety principle, requires that safety be improved until additional costs are in "gross disproportion" to additional benefits. Using PRA-based safety analysis reports, Safety Case results were compared with quantitative risk criteria. Standard analysis methods were developed that were shown to work at all types of facilities. Importance rankings were identified so resources, maintenance and training could be allocated according to identified priorities.

The safety case process in the U.K. has provided many new insights into the causes of risks and has facilitated ranking relative to risk importance. The program is regarded as a success with respect to both the development process and the resulting assessment methods. Throughout the process, the AWE and facility staffs worked closely together. Facility staffs took "ownership" of the process. New insights were gained into worker and public risks. Public risks were determined to be generally low. Many worker risks were found that could be improved to meet ALARA levels. A few risks were identified that were in need of urgent improvement. The total process was completed in less than three years.

The standardized, quantifiable basis for assessing risk provided by the PRA process enables managers to better determine the cost effective allocation of resources for the protection of the public and workers. The U.K.'s experience has shown that for any kind of complex facility, a risk-based analysis has identified subtle accident scenarios with systems interactions, for which there was not any real protection in place. A typical coarse hazards analysis will not pick these up. The U.K.'s use of PRA has resulted in cost saving benefits that far outweigh the initial costs of developing and implementing the methodology. Overall, the U.K.'s experience has shown that the use of modern quantitative risk assessment methods is the key to providing a rational, systematic and cost-effective means of evaluating plant safety.***RMQ***

In response to a growing recognition that risk assessment is playing an increasing role in decision making, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Pacific Northwest National Laboratory (PNNL) are exploring new approaches to risk management that incorporate tribal perspectives and principles. These perspectives differ from typical perspectives primarily in that they take a longer view and are spatially integrated over larger areas. However, in order to evaluate risk management options for performance on long-term health and environmental scales, this additional risk in-

The ***Risk Management Quarterly*** is published every three months – usually in January, April, July and October. Articles are reviewed before publication by the following members of the **DOE Editorial Review Board.** Welcome to the new members of the board from EM that joined us this issue. Board members are from DOE-HQ, located in the Washington DC area, unless otherwise noted**.**

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Risk Management, Environmental Justice, and Tribal Perspectives

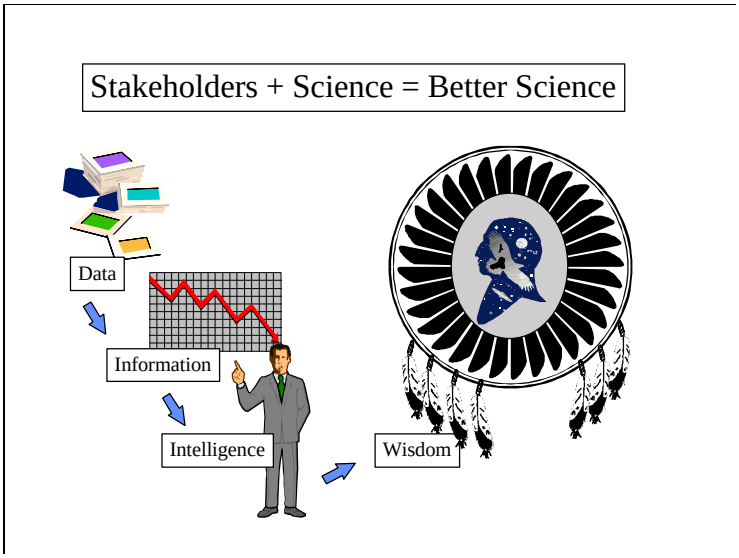
by Barbara Harper, Pacific Northwest National Laboratory and Stuart Harris, Confederated Tribes of the Umatilla Indian Reservation

formation, while not difficult to collect, must be deliberately targeted through a Data Quality Objective (DQO) process.

We have concluded that existing risk assessment methods can be modified fairly easily to address tribal information needs, that these modifications do not create an extra burden on managers who must generate the information, and that risk-based decisions based on that information would address many of the concerns expressed by tribal communities and other stakeholders. This approach has both retrospective applications (such as remediation of environmental contamination) and prospective applications (such as the issuance of new permits).

Tribal Perspectives on Health Evaluation and Risk Assessment

Our evaluation of risk assessment methods began with the recognition that Comprehensive Environmental Resource Compensation and Liability Act (CERCLA) exposure scenarios are suitable for suburban lifestyles but not for traditional tribal lifestyles that are still followed by tribal members. We further recognized that evaluating community health requires more than a simple estimation of exposures. Even today, tribal communities are so closely intertwined with the environment that environmental health and community health are essentially synonymous. Additionally, individual health is influenced by physical, psychological, and spiritual aspects as well as by the social and religious well-being of that individual's community, all of which requires a clean environment. For this reason, a tribal risk assessment would include parameters for environmental, economic, and sociocultural impacts as well as for human health over multiple generations. This approach is consistent with Executive Order 12898 and with the intent of the National Environmental Policy Act (NEPA). It is broader than the usual CERCLA assessment, but would provide additional support to CERCLA decisions.



To answer the first need (the lack of exposure scenarios suitable for traditional lifestyles), we developed a suite of Native American exposure scenarios. These scenarios focus on activities that would occur in various habitats (such as upland hunting, or riverine hunting and fishing). We began with CERCLA suburban exposure factors and evaluated which ones needed to be modified to account for increased environmental contact, increased ingestion of locally-gathered foods and medicines, and unique pathways such as use of the sweat lodge. This information was based on extensive interviews with tribal members (a process known as expert elicitation), but is proprietary information that belongs to the tribe. The basic subsistence scenario was used in the Tank Waste Remediation System Environmental Impact Statement (DOE/EIS-0189), and was the driving risk scenario among all the exposure scenarios that were evaluated.

To answer the broader need (whether the risk evaluation supports decisions based on overarching principles), it is useful to list some of the basic questions that tribal staff have to be able to answer when explaining the ramifications of federal decisions on their communities. The following questions relate to Hanford, which is located entirely on lands ceded by several tribes to the United States government and on which the treaties reserve many rights of access and use to tribal members.

- When will it be safe to exercise treaty-reserved rights on or near Hanford?
- What long-term risk commit-ments are being made by near-term decisions?
- What multi-generational impacts to human health will there be?
- What environmental and ecosystem quality will be left after Hanford is remediated?
- What impacts to tribally-important natural and cultural resources will occur during Hanford remediation, and what will their quality be after Hanford is remediated?
- Are some segments of the population disproportionately more affected than others?

Examples of Applying Tribal Principles to Risk Management Decisions at Hanford

The following examples are largely retrospective, since the Hanford mission is now, in part, to clean up the site so it is suitable for other

uses. Final cleanup levels and future uses remain to be determined, but information will be needed to evaluate the long-term consequences of near-term decisions. Federal obligations to protect treaty right and natural-cultural resources, and new commitments to integrated environmental management using principles of the international licensing standards of ISO 14000 suggest that making decisions without adequate long-term information could result in losing the ability of ever achieving those endstates, thus needlessly restricting the options for future land uses.

Example: Ten Year Plan. DOE's national Ten Year Plan is being prepared based on Ten Year Plans for each DOE facility. Tribes and stakeholders would like to see information about conditions that could exist beyond 10 years as disposal containment is eventually breached and multiple exposures occur in the future. These long-term risk commitments, along with natural and cultural resource commitments, are important for everyone to understand, because the decisions that are made in the next few years will affect people in future years.

Example: NEPA and Environmental Justice. Executive Order 12898 and DOE's Environmental Justice Policy require the evaluation of federal actions on segments of the population that would be disproportionately affected, including their health, resources, and welfare. Subsistence scenarios are specifically required where appropriate. While the subsistence scenario was used in one EIS at Hanford, the impacts to natural resources of cultural importance, to cultural resources, and to tribal culture itself were evaluated poorly if at all. CTUIR is developing methodology to better address these aspects, and can provide initial recommendations for satisfying these new federal requirements.

Example: CERCLA and cost-benefit analysis. Application of this approach to CERCLA could result in selection of different remedial alternatives. For example, using institutional controls in lieu of actual remediation would not be cost-effective if environmental impacts were monetized correctly in a cost-benefit context. Restoration of safe access to cultural and natural resources might lead to the selection of less intrusive remediation technologies than excavation, yet still be cost-effective if socio-cultural impacts were used to help establish cleanup goals.

Example: Strategic Planning. Strategic planning frequently includes risk ranking and prioritization but sometimes lacks a clear definition of long-term endstate goals. The long-term tribal perspective would require a comprehensive picture of the whole problem, beginning with questions such as: *Where are we now? Where do we want to go? How do we get there?* Once this is described, at least qualitatively, then various decision support tools such as risk assessment, alternatives assessment, and value of information can be selected. All of these are amenable to tribal needs as long as the information includes long-term and spatially integrated data.

Example: Environmental Justice-based Technology Research and Development (R&D). Environmental justice and tribal perspectives are relevant to two steps in the R&D selection process: (1) identification of the initial problem relative to long-term consequences and desired endstates, and (2) development of technology performance requirements that satisfy principles such as protection of natural and cultural resources. Applying these principles would result in preferential development of retrievable waste forms over irretrievable forms, and less-intrusive technologies over intrusive ones.

Conclusion

What legacy do we want to leave for our children, for they will inherit the consequences of decisions that we will make over the next few years? We do not want to impose larger cleanup burdens on them if we fail to take action now. We do not want to preclude their options of future additional cleanup by generating irretrievable waste. We do not want to limit their future land use options by making decisions that result in permanent loss of resources or long-term environmental degradation. We want to leave them conditions that allow them a full range of land use options, which means that we should always consider the long-term and big-picture consequences of our decisions. ***RMQ***

Submittal of articles for **the *Risk Management Quarterly is*** encouraged. We can best provide a variety of interesting articles if they are submitted by the practitioners of risk assessment and risk management. Articles should be mailed, faxed or E-mailed to Lane Environmental, Inc. at 2000 Logston Boulevard, Richland, WA 99352
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Articles should be 800-1200 words in length and include one or two figures to accompany the text. Articles should be cleared locally as needed before submittal. The ***RMQ*** Editors will make the final decision on which articles to print.

Correction. Some of the Internet addresses in the last issue can not be found as reported. The following addresses **are** correct:
http://www.doe.gov
http://www.osha.gov
http://www.dol.gov
http://www.ids.ac.uk/eldis/envimp/eia_lele.html

The CRESP address has changed to:
http://www.cresp.org/
and Risk Management Information for Those Just Getting Started can be found at:
http://www.greatbasin.net/~nvprima/basic.htm

The other addresses do not respond. We apologize for any inconvenience this may have caused our readers.

New Version of Assessment System Ready for Testing

by Barry Parks, Health Physicist, U.S. Department of Energy

The Energy Research Office of ES&H Technical Support at the U.S. Department of Energy is now distributing a draft version of CAP88-PC, version 2.0, for beta testing. CAP88, which stands for "Clean Air Act Assessment Package (1988)" is widely used by DOE facilities to demonstrate compliance with EPA standards for radionuclide emissions to air (40 CFR 61 Subpart H). It is also used for calculating dose for documents required by the National Environmental Policy Act, and for many EPA and State permits. More than 1,000 copies of the original CAP88 have been distributed since the system was developed in March 1992 as part of a cooperative effort by DOE and EPA. Users include scientists in Federal and State government, private industry, and academic institutions.

The beta-test copy of version 2.0 is a Windows application that implements a new graphical user interface for the CAP88 dose assessment software, which is used to calculate dose and risk for radionuclide releases to air. This version also incorporates new utilities for preparing and managing population and weather data.

The software is available for downloading on the World Wide Web. To obtain a copy, just set your World Wide Web browser to this URL: http://www.er.doe.gov/ production/esh/cap88pc.html

The CAP88-PC software package allows users to perform full-featured dose and risk assessments in a personal computer environment. CAP88-PC can be used for assessments of both collective populations and maximally-exposed individuals, and allows full editing of many environmental transport variables.

CAP88-PC uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from up to six sources. The sources may be either elevated stacks, such as a smokestack, or uniform area sources, such as a pile of uranium mill tailings.

CAP88-PC can be used for assessments of both collective populations and maximally-exposed individuals, and allows full editing of many environmental transport variables.

Plume rise can be calculated assuming either a momentum or buoyancy-driven plume. Assessments are done for a circular grid of distances and directions with a radius of 80 kilometers (50 miles) around the facility.

The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food and intake rates to people from ingestion of food produced in the assessment area. Estimates of the radionuclide concentrations in produce, leafy vegetables, milk, and meat consumed by humans are made by coupling the output of the atmospheric transport models with the U.S. Nuclear Regulatory Commission Regulatory Guide 1.109 terrestrial food chain models. ***RMQ***

An interesting article about the effects of low-level radiation appeared recently in the Washington Post. The title is: Atomic Split: Data Recharge Debate on Low-Level Radiation Risk by Joby Warrick. You can find it at this web address: http://search.washingtonpost.com/wp-srv/WPlate/1997-04/14/067L-041497-idx.html

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